Implement a Unit Waste Management Plan
05-2-7501

January 2012

Terminal Learning Objective

- ✓ CONDITION: As an element designing a base camp in a deployed environment, and given access to environmental guidance provided in the references.

- ✓ STANDARD: Design an integrated waste management plan that addresses the waste streams generated by the base camp.

Safety, Risk and Environmental Concerns

- ✓ Safety Requirements: None
- ✓ Risk Assessment Level: Low
- ✓ Environmental Considerations: Training entirely of an administrative nature, with little or no environmental impact

References

- ✓ TM 38-410 Storage and Handling of Hazardous Material
- ✓ FM 3-34.5 Environmental Considerations
- ✓ TC 3-34.489 The Soldier and the Environment
- ✓ FM 5-19 Composite Risk Management
- ✓ AR 200-1 Environmental Protection & Enhancement
- ✓ Waste Management Handbook for Deployed Forces (TM 3-34.56)

Learning Objective #1

Describe the components of an integrated waste management plan.

Integrated Waste Management

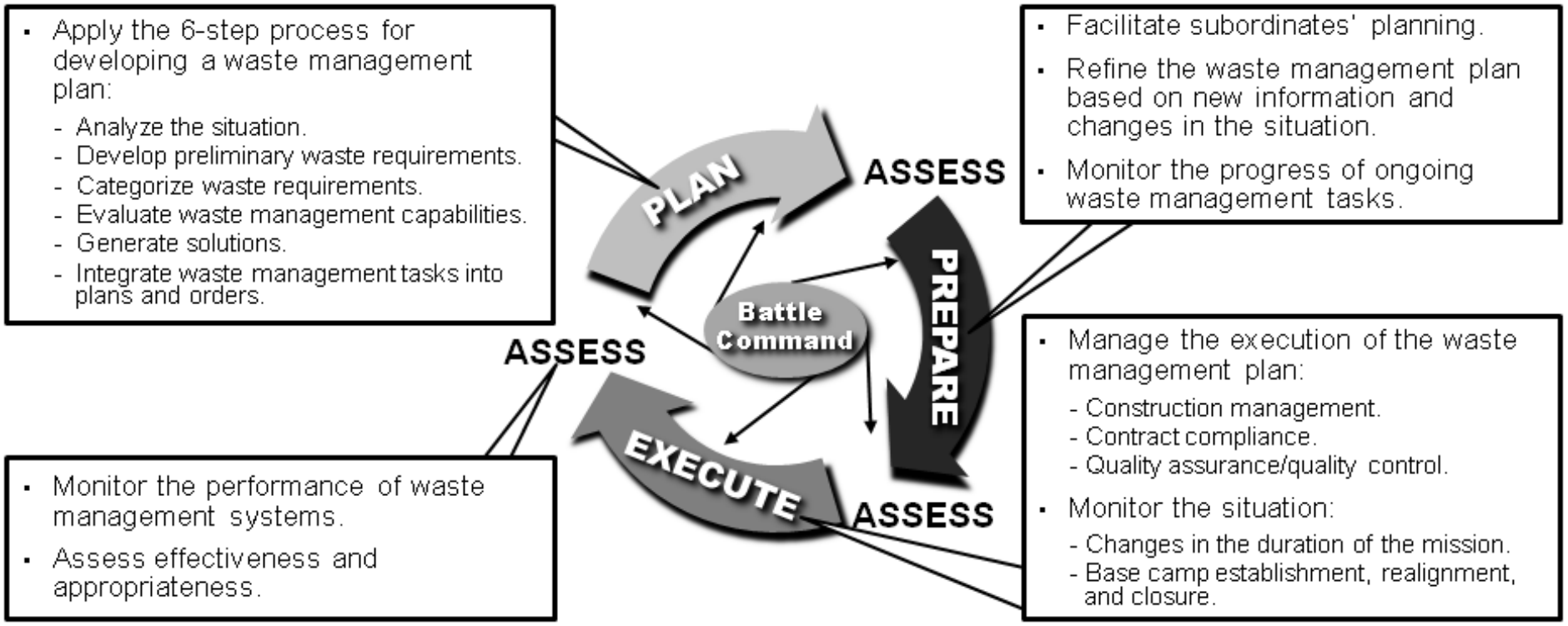
A process of using a variety of practices to handle wastes safely and effectively.

Nonhazardous Solid Waste

Wastewater

Hazardous Waste

Determine the amount and type of waste streams

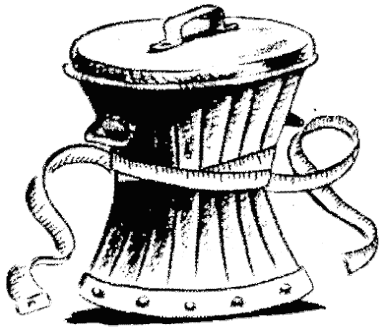


Integrated Waste Management Hierarchy

Avoidance

The 4 R’s

Reduce
Reuse
Recycle
Responsibility



Composting

- The controlled process of organic degradation or waste decomposition.

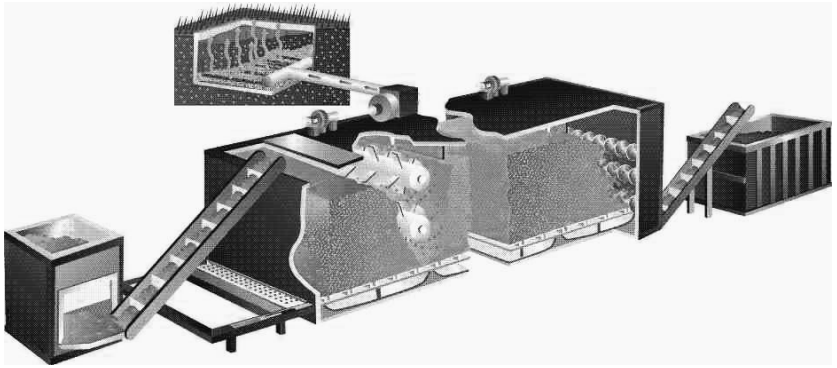
- Transforms a potential waste into a beneficial product.

Composting

Pile Composting

Static Pile

Windrow



In-Vessel/Container System

Disposal

Check on Learning

What are the three Priorities in the integrated waste management hierarchy?

Learning Objective #2

Describe the methods of disposal for non-hazardous solid waste.

Segregation

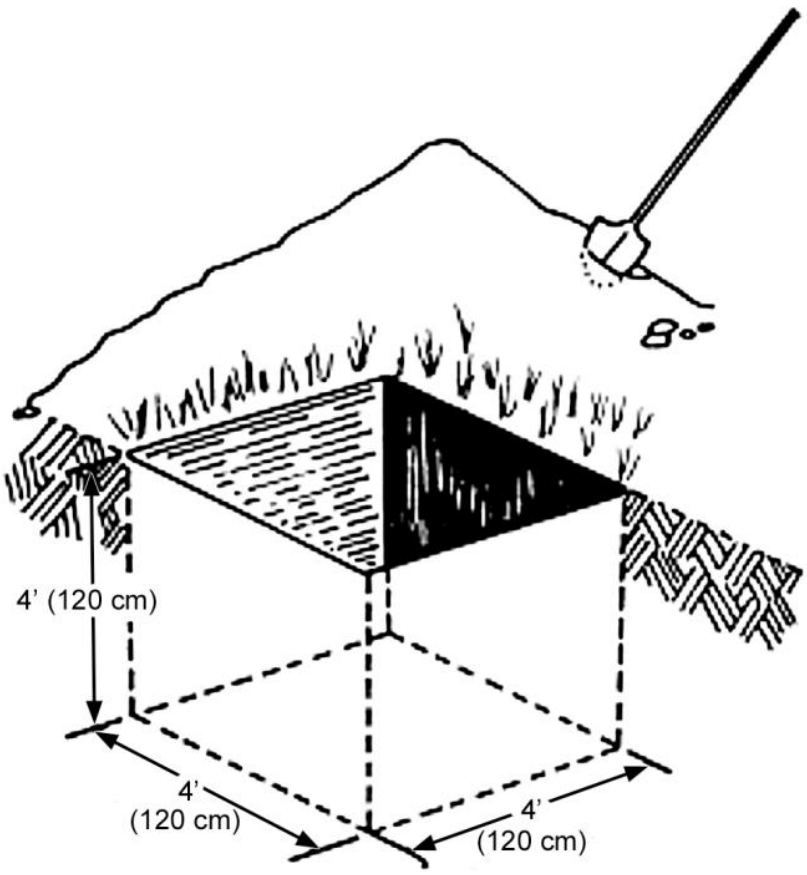
- Wood
- Scrap Metal
- Combustibles
- Plastics
- Batteries

Recycling bins for plastic bottles

Segregated bins for wood, metal, and a dumpster for other trash

Tactical Waste Burial

- Located 100 meters from water source
- Coordinates recorded and reported to higher headquarters.



Landfill

An area of land or excavation where waste is placed for permanent disposal that has engineering controls to protect the environment.

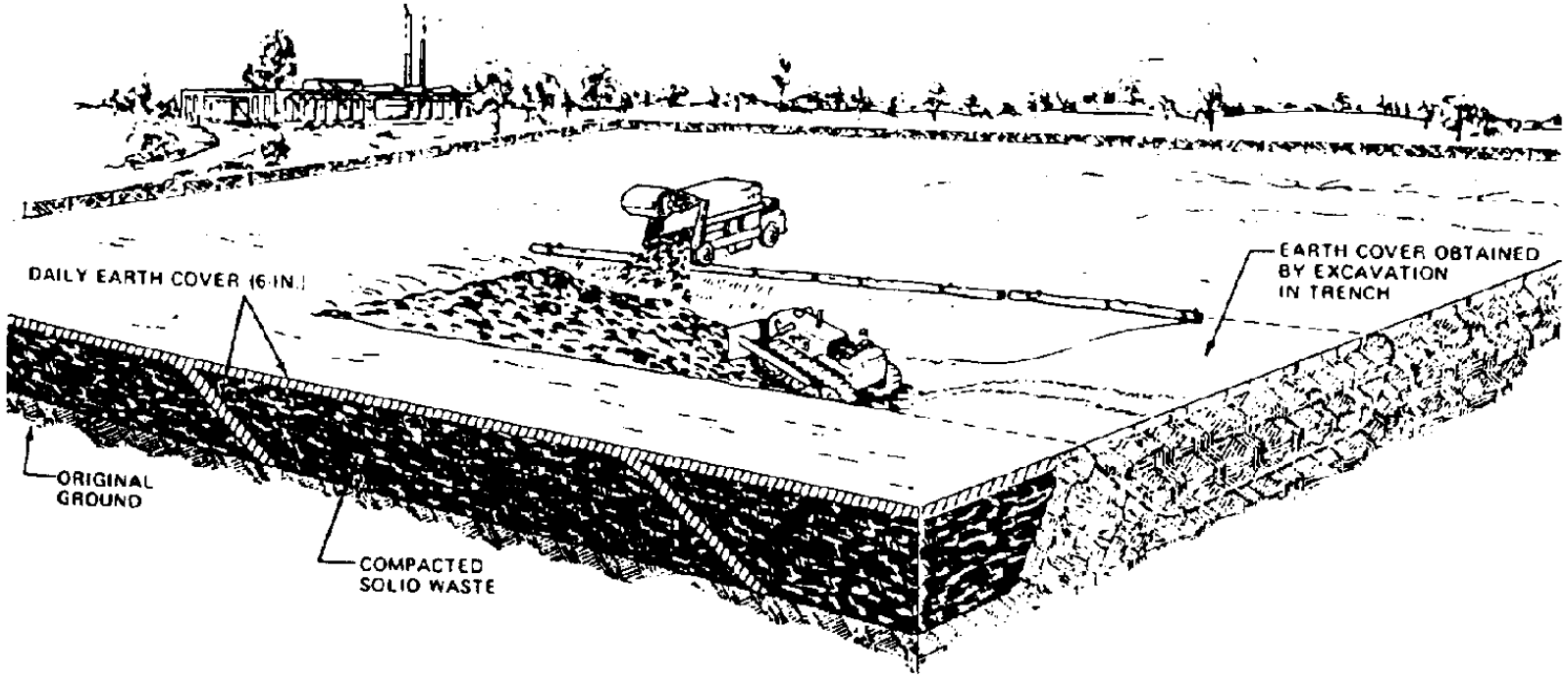
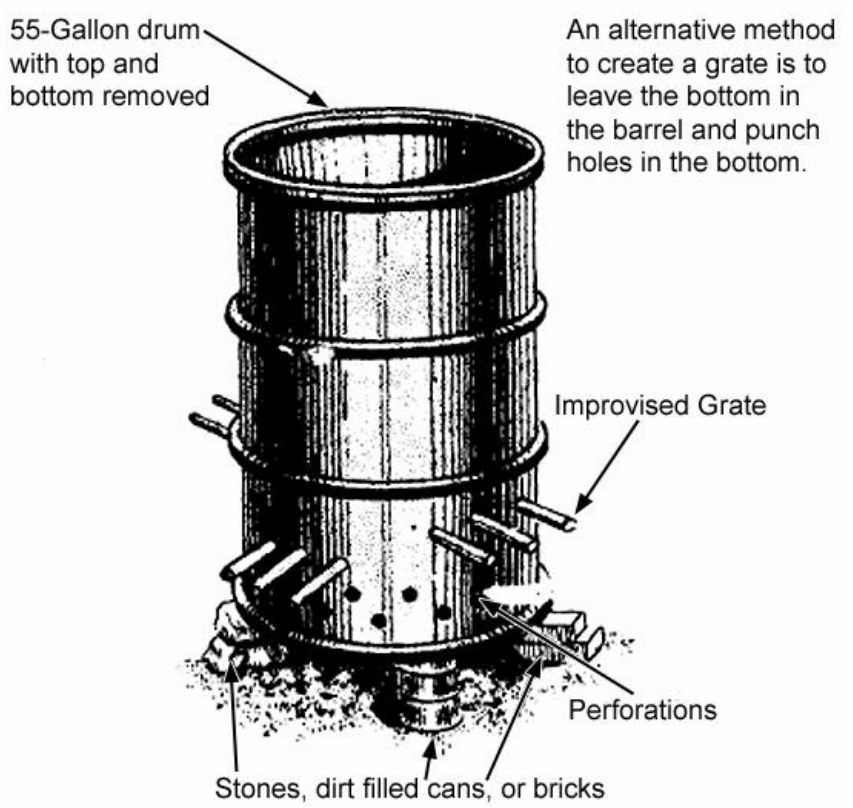


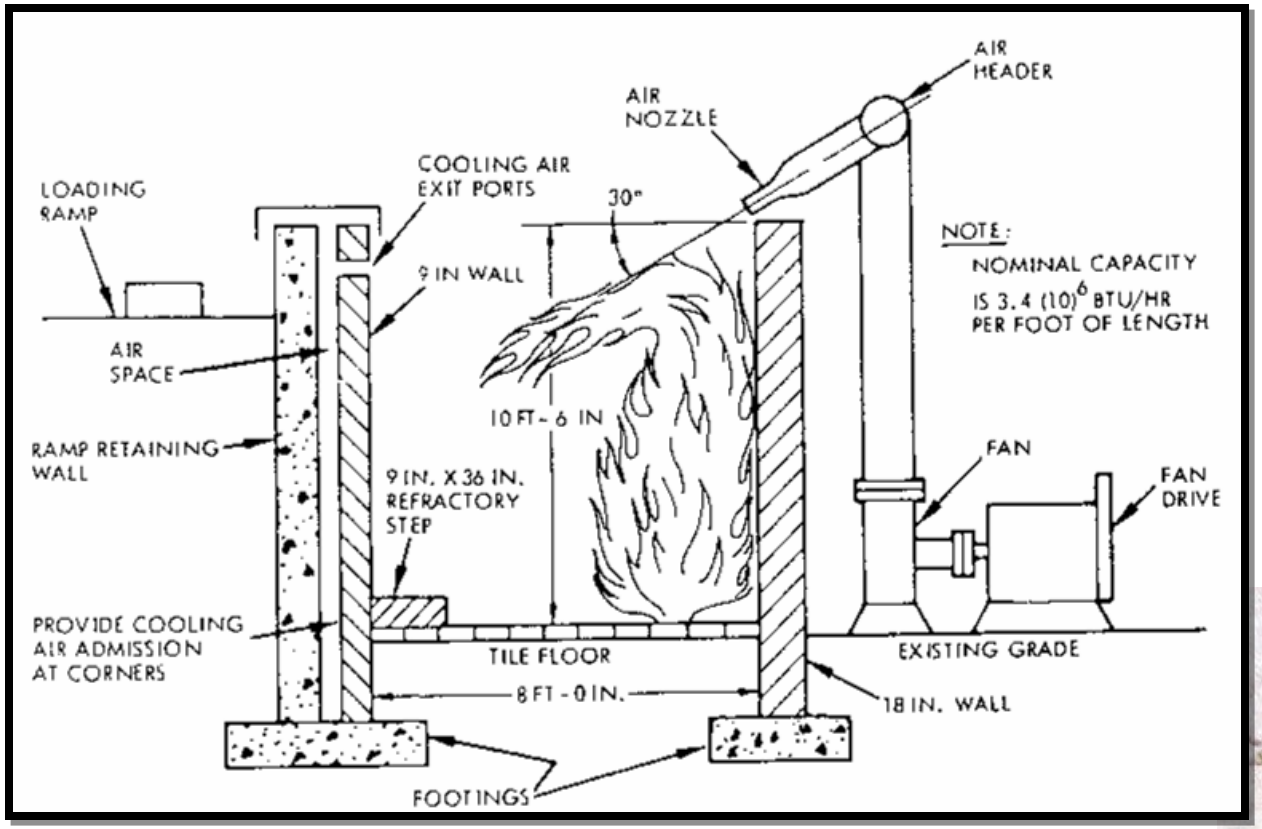
Figure 2–1. Typical Trench Landfill Operation.

Incineration

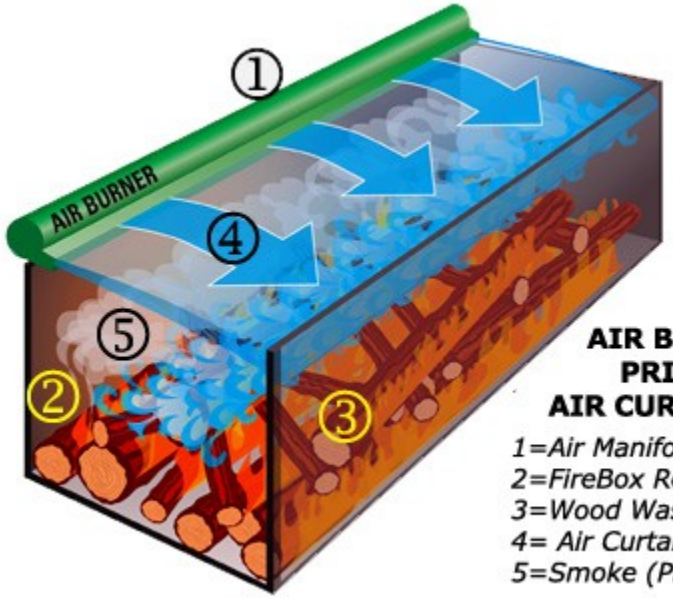
The barrel incinerator will effectively handle SW produced from a company sized element.



Open Pit Incinerators



Air Burners/Incineration



AIR BURNERS, LLC
PRINCIPLE OF
AIR CURTAIN BURNING

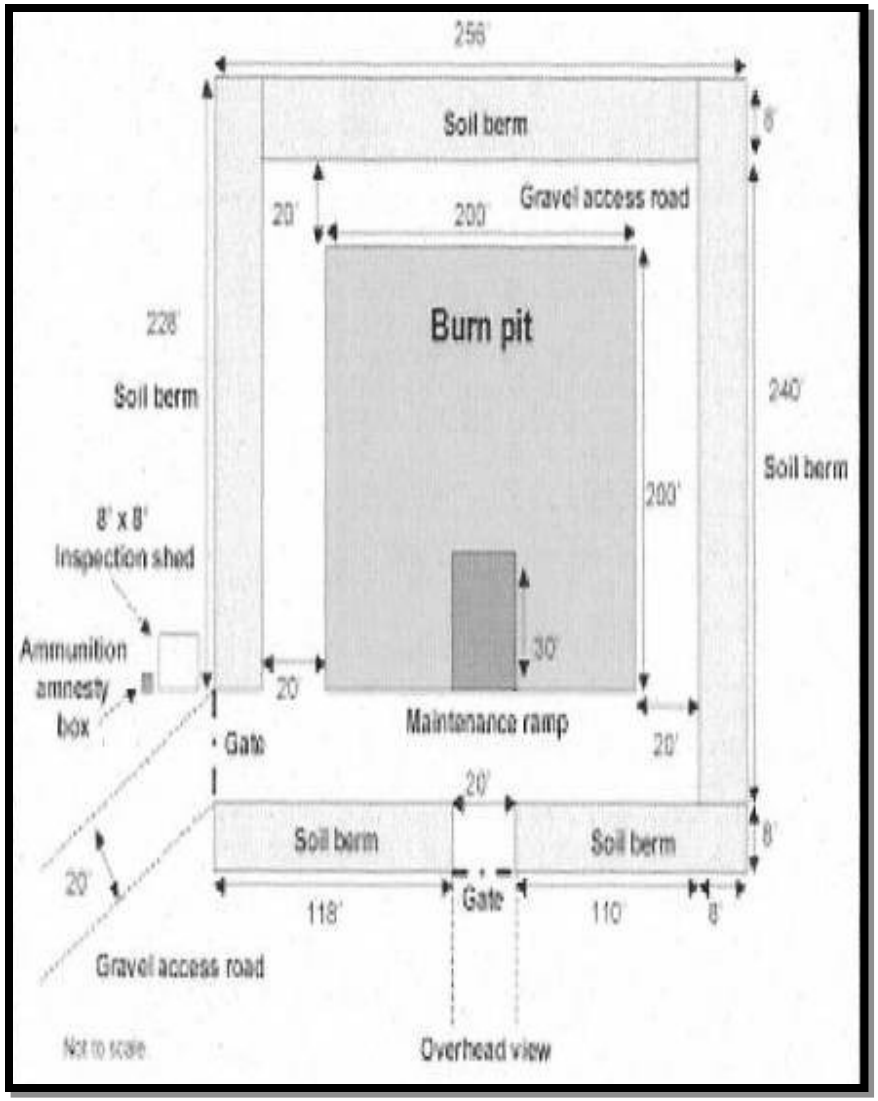
1=Air Manifold
2=FireBox Refractory Wall
3=Wood Waste or Wood Fuel
4= Air Curtain (left to right)
5=Smoke (PM)

Industrial Incinerators

- Advantages
  - Limited Real Estate
  - Burn pit not feasible or permitted
  - Reduce air pollution hazard for troops
- Disadvantage
  - Training (O & M)
  - Availability
  - Cost
  - Ash disposal

Burn Pit Design

Burning should be a last resort.



Check on Learning

What is the best management approach for collecting solid waste?

Learning Objective #3

Describe the methods of disposal for hazardous waste.

Waste Determination

There are two ways a waste can be regulated as hazardous:

- ✓ Meets the definition of one or more of the following characteristics:
  - ignitable, corrosive, reactive and toxic.
- ✓ Is listed by EPA as a hazardous waste in 40 CFR 261.

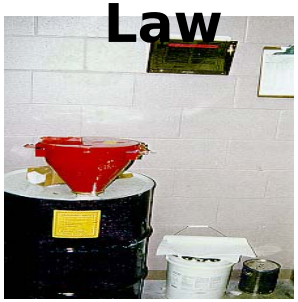
HM Transformation to HW

Expires

By Law

Discarded

Unusable

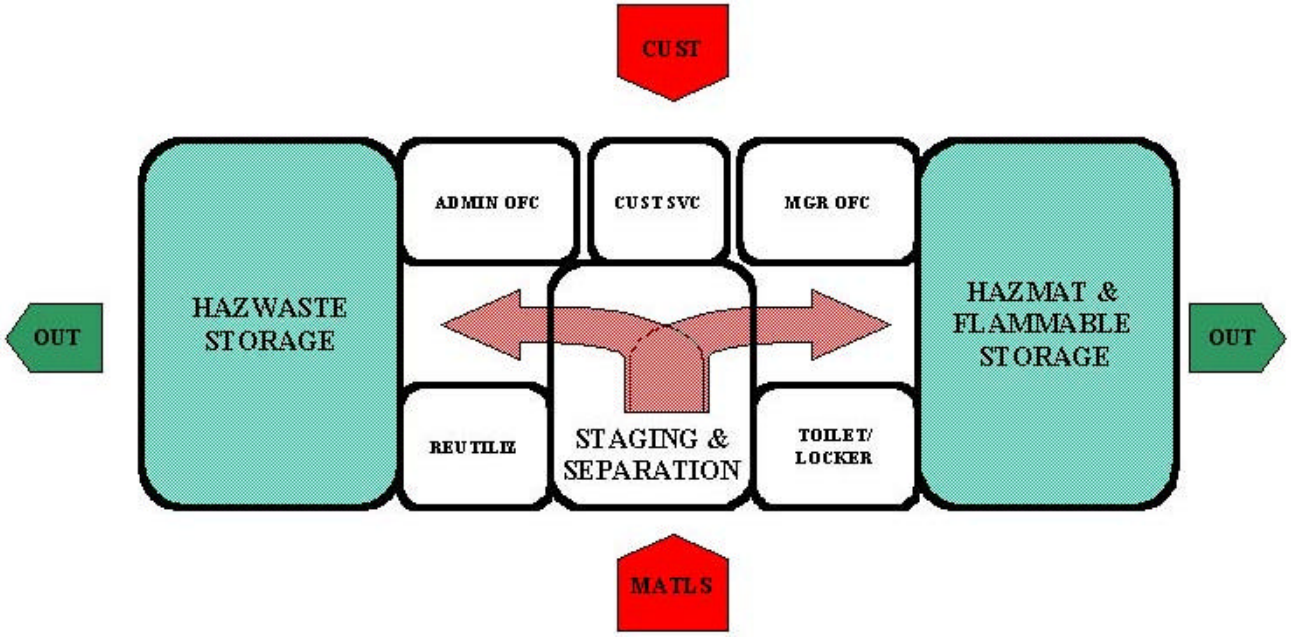


Mixtures

Contamination

Establishing a HAZMART

Provides quicker response for mission essential materials and a reduction in the hazardous material placed on the functional organizations and a reduction in the generation of hazardous waste.



HAZMART General Criteria

- Computer with database and barcode equipment
- Telephone/radio
- Intrinsically safe wiring/outlets
- Shelved storage bays
- Drum storage bays
- Spill containment pits
- Scales
- Safety area and equipment
  - Fire suppression/extinguishers
  - Eyewash/Safety Shower
  - Grounding equipment
  - Spill Kits
  - Overpack equipment and materials
- Crane Chain Lifting device (3000 lbs max)

Container Management

- ✓ HM/HW containers must have proper shipping name.
- ✓ HM/HW container must be marked and labeled according to directives.
- ✓ Mark the name and address of either the sender or receiver.
- ✓ Use the original container, to the extent possible, to accumulate and transport HM/HW.
- ✓ Inspect containers routinely.
- ✓ Protect containers from

Container Management

- ✓ Do not overfill containers.
- ✓ Do not stack drums more than 2 high.
- ✓ Do not stack flammables.
- ✓ Ensure there are at least 3 feet between containers (aisle space).
- ✓ Store in approved cabinets, rooms and buildings.
- ✓ Ensure containers have lids and are kept closed when not being filled.

Filling Containers

- ✓ **Waste deposited in containers must be compatible with the container (ex. Don’t put corrosives in metal containers.)**
- ✓ **Check for headspace to allow expansion.**
- ✓ **Do not mix waste without direction. Examples of segregated waste:**
  - **Used oil, hydraulic, and brake fluids**
  - **Solvents**
  - **Paints and thinners**
  - **Acids**

DLA Recommended HW Segregation

General HW Accumulation Requirements

- ✓ Countdown starts with the first drop of material
  in accumulation, check your SOP.
- ✓ Practice Good Housekeeping.
  - Segregation
  - Secondary containment
  - Adequate aisle space
- ✓ Inspect weekly for leaks/deterioration.
- ✓ Annotate on accumulation log.
- ✓ Accumulate by characteristics and separate by a dike, berm or wall in main accumulation area.

Hazardous Waste Accumulation Point (HWAP)

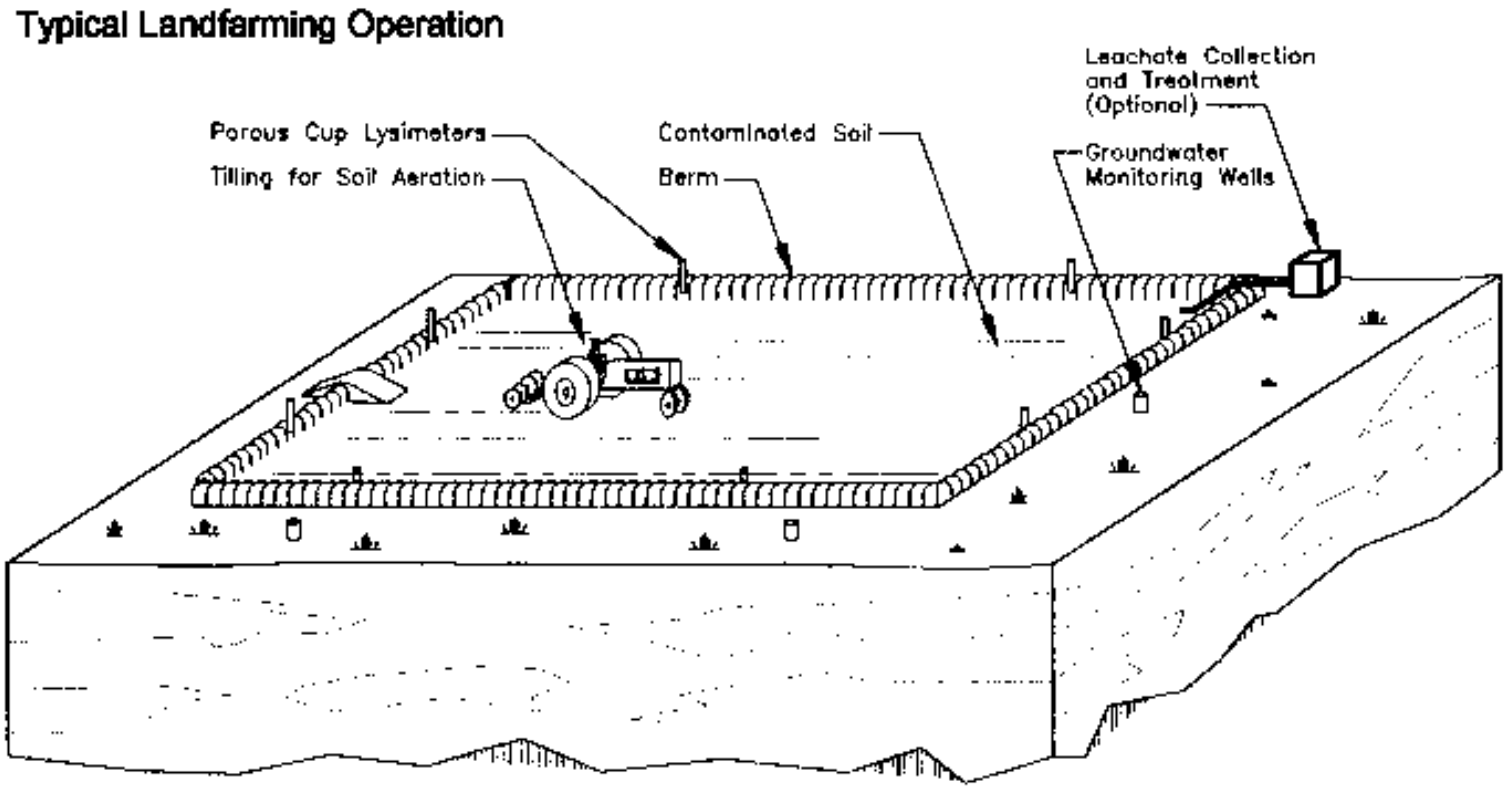
- ✓ Containers cannot be larger than 55 gallons or 1 quart for acute HW.
- ✓ Containers are located near the HW point of origin.
- ✓ Containers controlled by generator.
- ✓ Containers must be clearly marked.
- ✓ Containers must be dated once first drop of waste is put in the container.
- ✓ Full containers must be turned in within 72 hours (includes non-business days).

SPILL DRILL

This is the basic SPILL DRILL but every unit should have a tailored plan depending on the liquid hazards found in the unit.

Landfarming

A bioremediation technology



Check on Learning

What are a few of the general hazardous waste accumulation requirements?

Learning Objective #4

Describe the methods of wastewater disposal.

Wastewater

- Associated Health Threats
  - Untreated sewage contains pathogens
  - Pathogens cause a wide variety of illnesses from diarrhea to infections
- Solution
  - Ensure wastewater is treated before released onto the ground or stream.

Wastewater

- Grey Water
  - Shower water, DFAC, laundry, ROWPU brine
  - Evaporation pond or storage tank
- Black water
  - Water contaminated with human waste
  - Not suitable for reuse
  - Must be treated in Lagoon, package plant, or facility capable of treating the waste

5 Step Process for Managing Wastewater

1. Analyze the Situation

- The layout of the base camp
- Generation rates
- Available facilities

2. Develop Wastewater Requirements

- Determine requirements for each phase based on expected duration
- Evaluate available capabilities and resources

5 Step Process Continued

3. Evaluate Waste Management Capabilities
    - Manpower, equipment, materials, funding
4. Generate Solutions
    - Take advantage of existing structures
    - Capability based solutions
    - Suitable based on risks to human health
5. Integrate Waste Management Tasks into Plans and Orders
    - Include waste management plans in logistics rehearsals

DISPOSAL OF HUMAN WASTES

General Requirements for Latrines

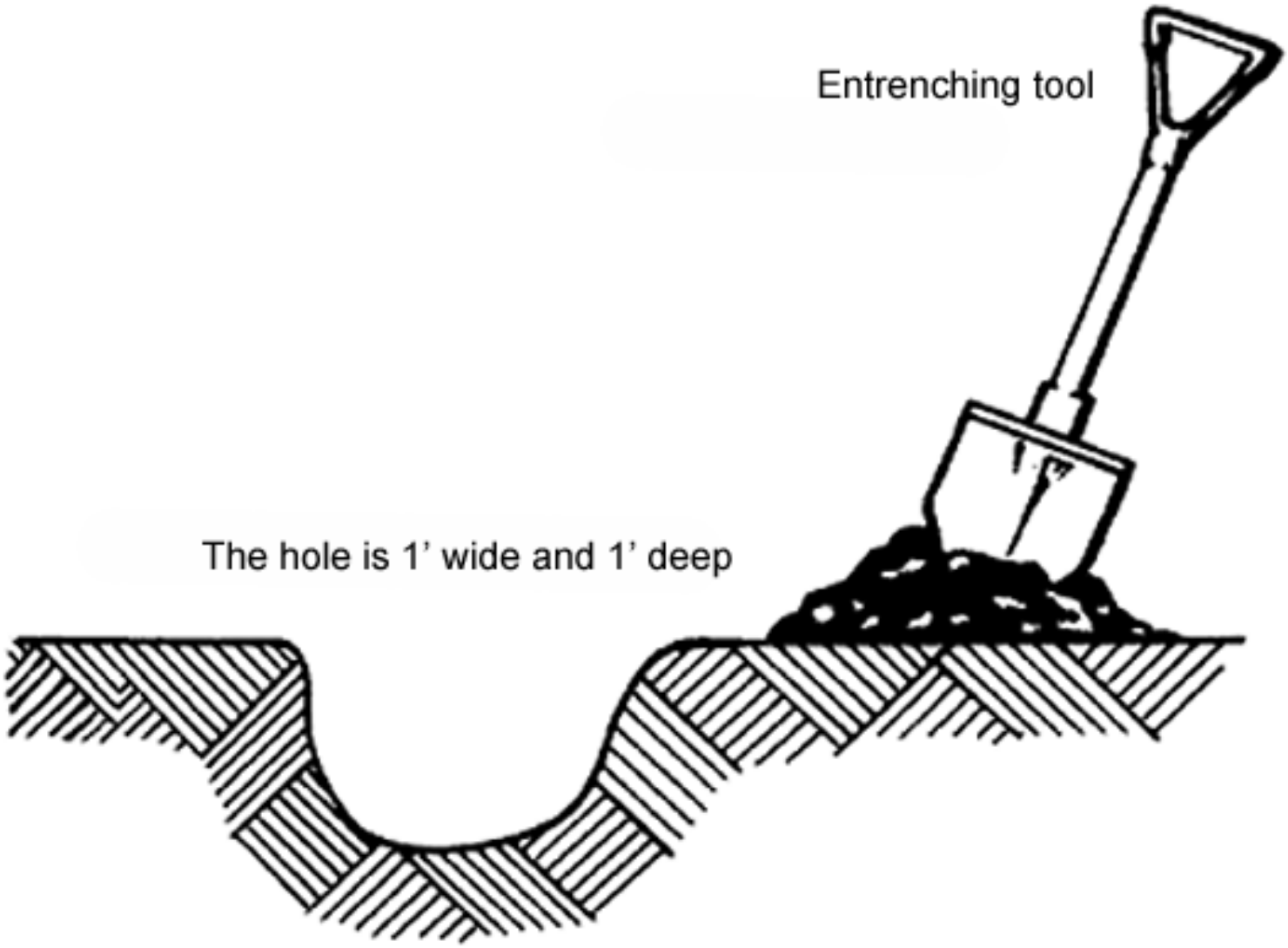
- Adequate numbers of latrines are 4% for males and 6% for females.
- Constructed at least 100 yards and downwind from the DFAC
- At least 100 yards and downhill from any surface water source, if possible or even further.
- Not dug to ground water level.
- Built at least 30 yards from the unit area or within reasonable distance for troops.
- A drainage ditch is dug around the edges of the latrine.
- Hand washing device is needed.

Field Methods of Latrine Design

- Cat-Hole
- Straddle latrine
- Deep Pit latrine
- Bored Hole
- Soakage Pits
  - Pipe urinals

- Burn Out Latrine

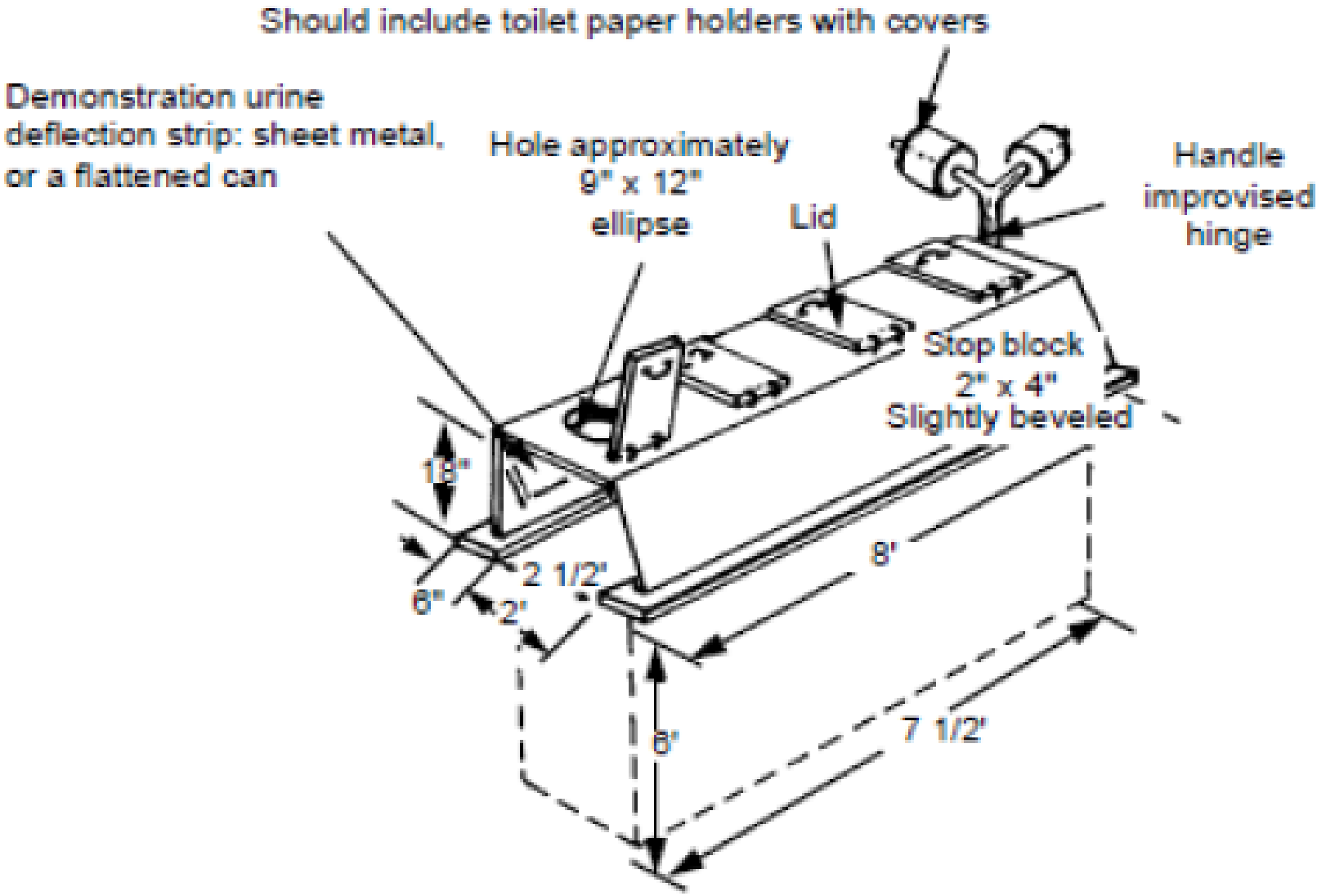
Cat-Hole latrine



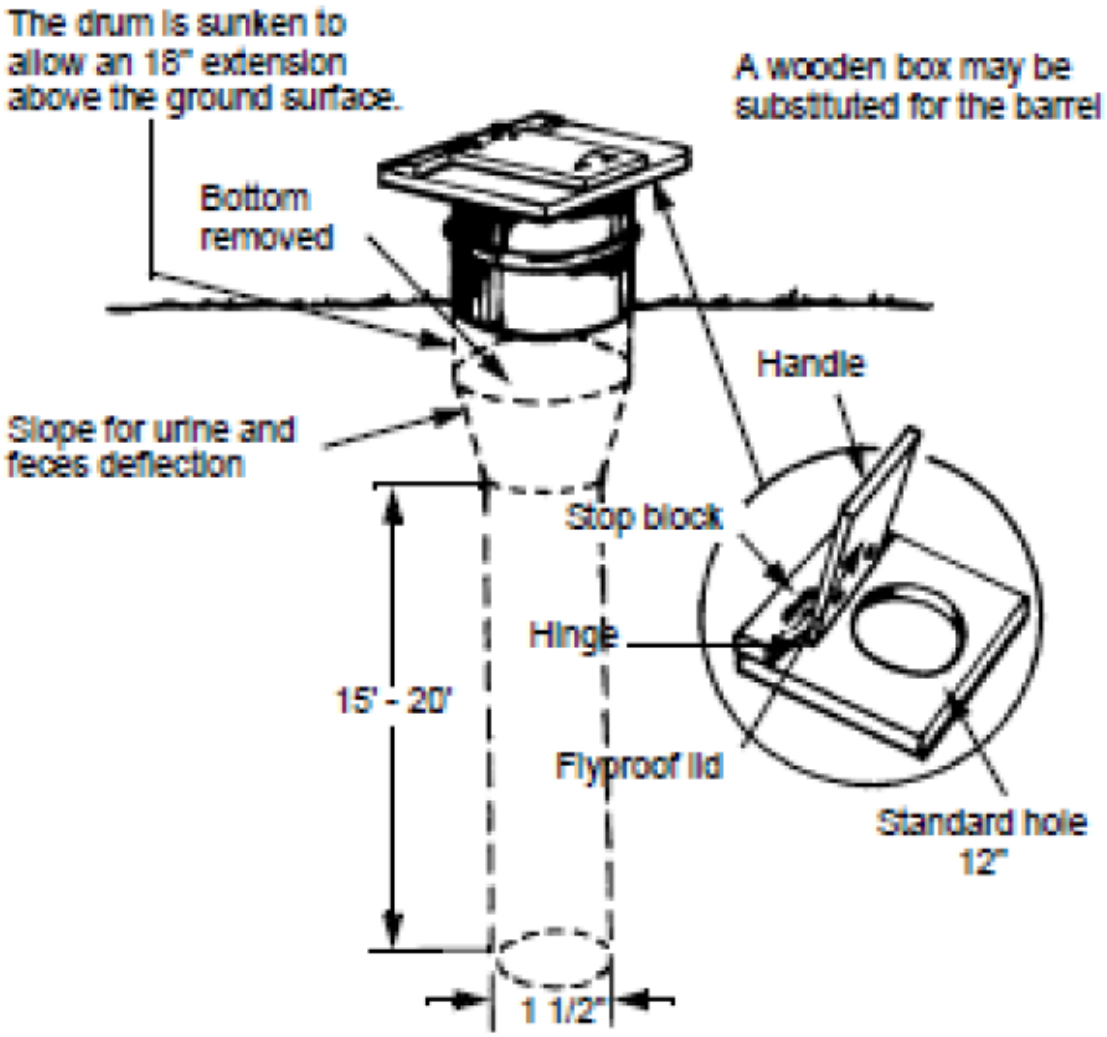
Straddle Latrines

- Temporary bivouac sites of (1 to 3 days) until more permanent facilities are made.
- A trench is dug 1 foot wide, 2 1/2 feet deep, and 4 feet long.
- 2 ft. of length used per person.

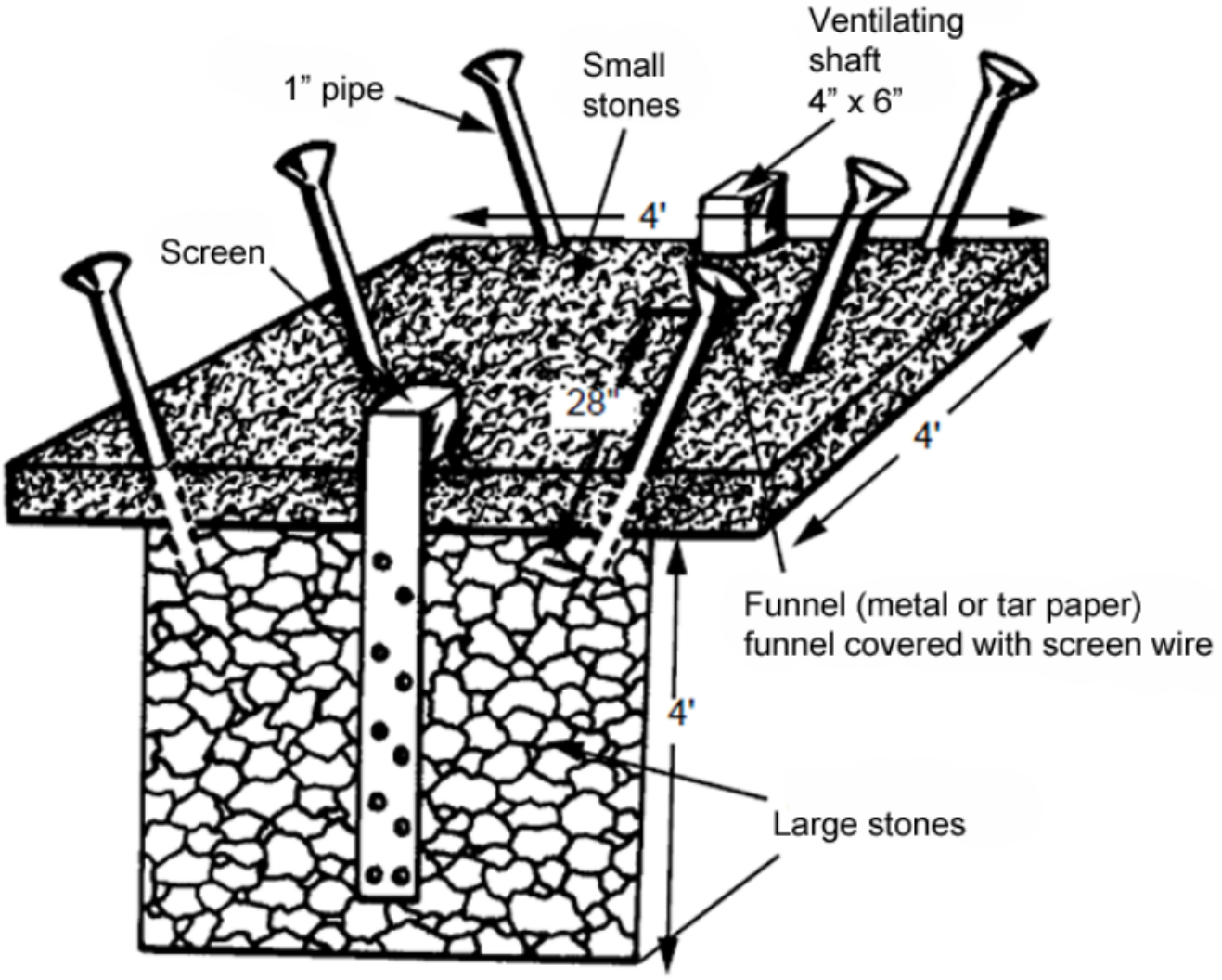
Deep Pit Latrine



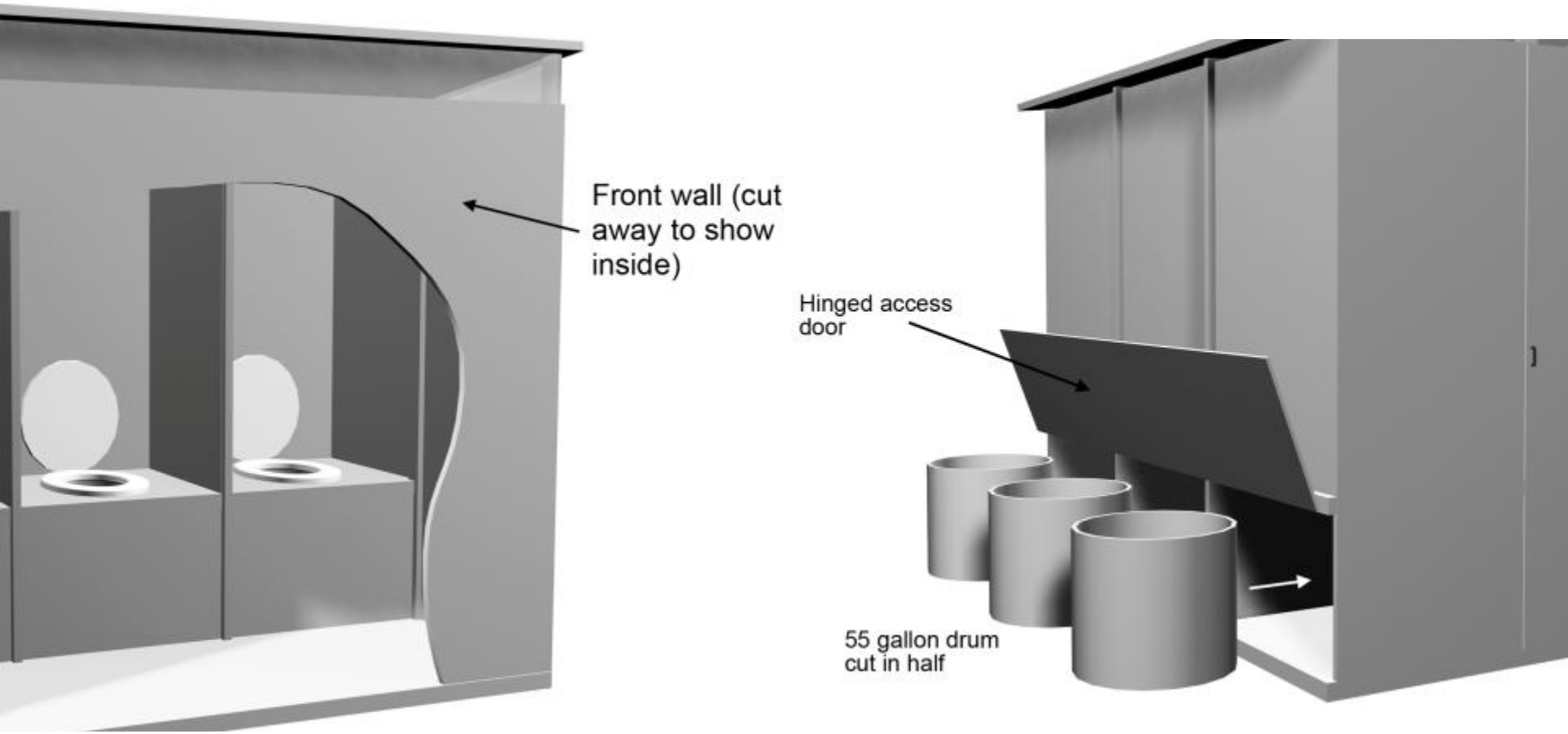
Bored Hole Latrine



Soakage Pit with Pipe Urinals



Burn out Latrine



Wastewater Treatment Systems

- Sewage lagoons
- Package Plants
- Conventional Treatment Systems

Wastewater Lagoons

- **Anaerobic Lagoons** are designed to hold and treat wastewater from 20 to 150 days. They are relatively deep (usually 8 to 15 feet) and work much like septic tanks.

- **Aerobic Lagoons.** Wastewater usually must remain in aerobic lagoons from 3 to 50 days to receive adequate treatment. Wastewater treatment takes place naturally in many aerobic lagoons with the aid of aerobic bacteria and algae. Because they are so shallow (less than 3 feet), their bottoms need to be paved or lined with materials that prevent weeds from growing in them.

- **Facultative Lagoons.** The wastewater in facultative lagoons naturally settles into three fairly distinct layers or zones. Different conditions exist in each zone, aerobic, anaerobic and a mix of both, and wastewater treatment takes place in all three. They are generally 8 to 15 feet deep.

Wastewater Lagoons Discharge Design

- **Continuous Discharge Lagoons.** These lagoons release wastewater continuously to a holding pond, so the rate of output roughly equals the rate of input. The hydraulic flow pattern in the lagoon is designed so the wastewater remains in the lagoon long enough to receive treatment before it reaches the outlet.

- **Controlled Discharge Lagoons.** In these lagoons, wastewater is discharged in controlled amounts, usually once or twice per year. This method is common in cold climates where discharges typically occur after spring thaw and again in fall.

Wastewater Lagoons Discharge Design

- **Complete Retention Lagoons.** These lagoons are only practical in very dry climates where evaporation rate greatly exceeds rainfall amounts. Wastewater is never released from this type of lagoon. Instead it is allowed to evaporate.

Wastewater Lagoons

- In systems that employ more than one lagoon, each lagoon cell has a different function to perform, and a different kind of lagoon design may be used for each cell.

- **In Series.** When lagoons operate in series, more of the solid material in the wastewater, such as algae, has an opportunity to settle out before the effluent is disposed of.

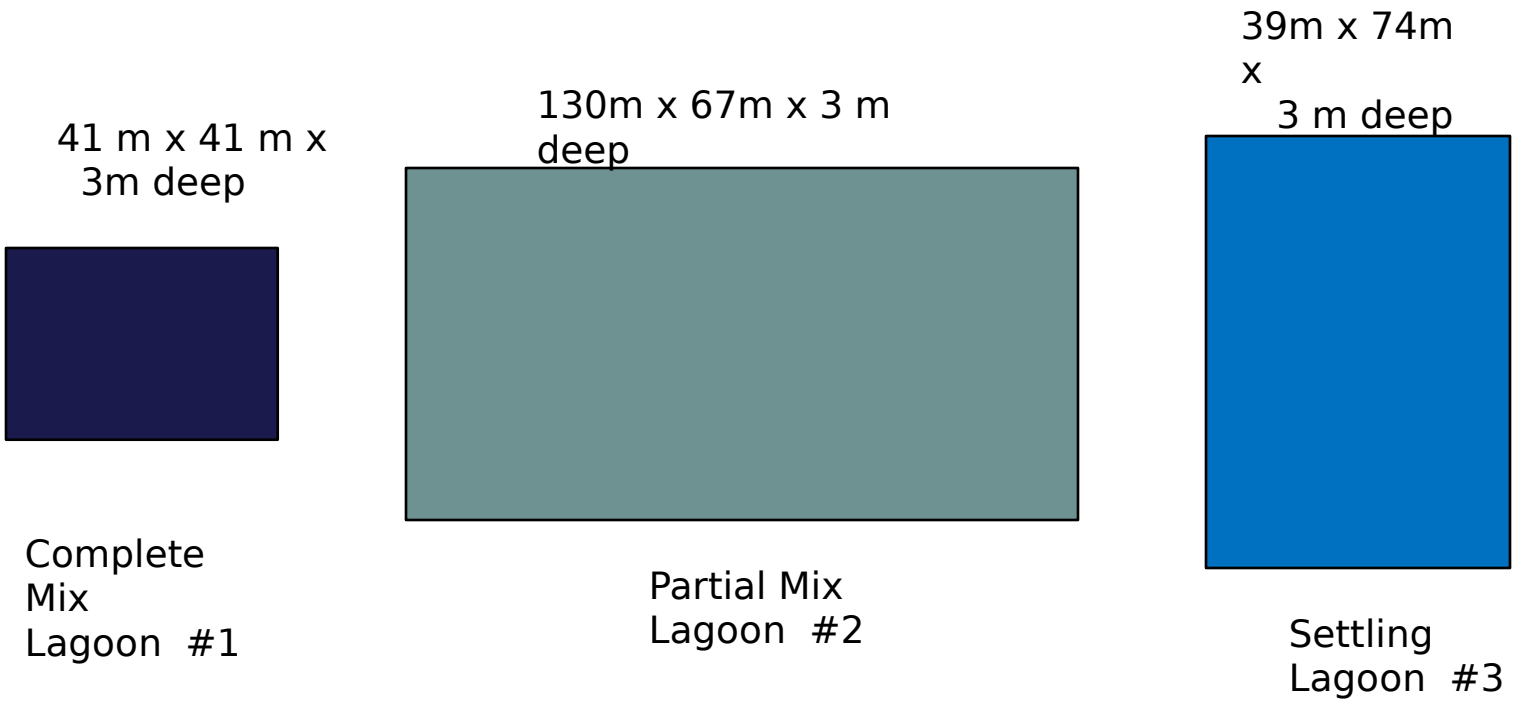
- **In Parallel.** Is a system has more than one cell that is receiving wastewater at the same stage of treatment. This system design is particularly useful in cold climates or where lagoons are covered with ice for parts of the year.

- Aerated lagoons are common in small communities. These systems use aerators to mix the contents of the pond and add oxygen to the wastewater. They are sometimes referred to as partial-mix or complete-mix lagoons depending on the extent of aeration.

Lagoon Design

In general, facultative lagoons require about one acre (0.4 hectares) for every 200 people they serve. Aerated lagoons treat wastewater more efficiently, so they tend to require anywhere from one-third to one-tenth less land than facultative lagoons.

Sanitary Waste Water Design -TCMS



Complete Mix Lagoon #1 41 m wide x 41 m long x 3 m deep; BOD is 360 mg/liter with two day detention time

Partial Mix Lagoon #2 67 m wide x 130 m long x 3 m deep; BOD is 20 mg/liter with 16 day detention time

Settling Lagoon #3 39 m wide x 74 m long x 3 m deep; BOD is less than 20 mg/liter with 4 day detention time

Wastewater Lagoons

Advantages

- Lagoon systems can be cost-effective to design and construct in areas where land is inexpensive.
- They use less energy than most wastewater treatment methods.
- They are simple to operate and maintain and generally require only part-time staff.
- They can handle intermittent use and shock loadings better than many systems, making them a good option for campgrounds, resorts, and other seasonal properties.
- They are very effective at removing disease-causing organisms (pathogens) from wastewater.
- The effluent from lagoon systems can be suitable for irrigation (where appropriate), because of its high-nutrient and low pathogen content.

Disadvantages

- Lagoon systems require more land than other treatment methods.
- They are less efficient in cold climates and may require additional land or longer detention times in these areas.
- Odor can become a nuisance during algae blooms, spring thaw in cold climates, or with anaerobic lagoons and lagoons that are inadequately maintained.
- Unless they are property maintained, lagoons can provide a breeding area for mosquitoes and other insects.
- They are not very effective at removing heavy metals from wastewater.
- Effluent from some types of lagoons contains algae and often

Package Plants

Sewage treatment plants are available in a modular or package form, for applications of 1,000 to 1,000,000 gpd and larger

TYPICAL COMPONENTS OF A PACKAGE PLANT

Equalization Chamber
Aeration Chamber
Clarifier(s)
Sludge Holding Tank
Disinfection
Blowers
Misc. Pumps
Control Package

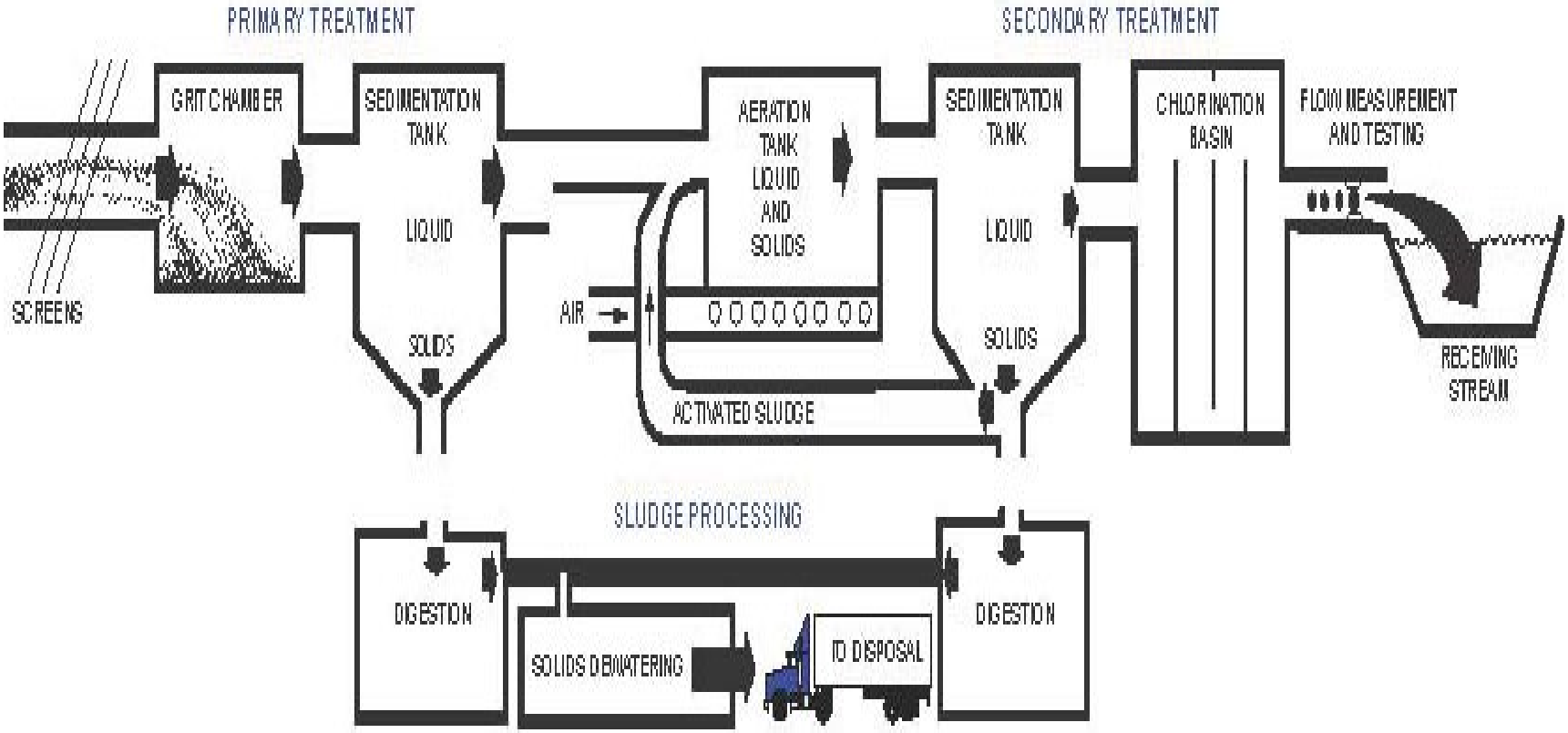
Package Plants

HOW A PACKAGE PLANTS WORKS

1. Wastewater gravity flows or is pumped to a mechanical separator.
2. It then flows into the equalization tank where the aeration process begins.
3. Wastewater from the tank then flows into the aeration chamber where the BOD, Suspended Solids, and Ammonia is reduced to design criteria levels.
4. The clarifiers are sized so as to allow enough retention time (typically 24 hours) for the flocking (aerated sludge or mixed liquor) to settle to the bottom of the clarifier's hopper where a small amount is continually removed and transported to the sludge holding tank.
5. Further aeration and concentration through decant-siphoning takes place in the sludge holding tank.
6. Water from the clarifier area continues to flow into the disinfection chamber where chlorination or UV treatment takes place. The water at this point has reached design effluent

Conventional WWTP

Conventional Wastewater Treatment Operation



Check on Learning

What are the three primary types of waste disposal systems?

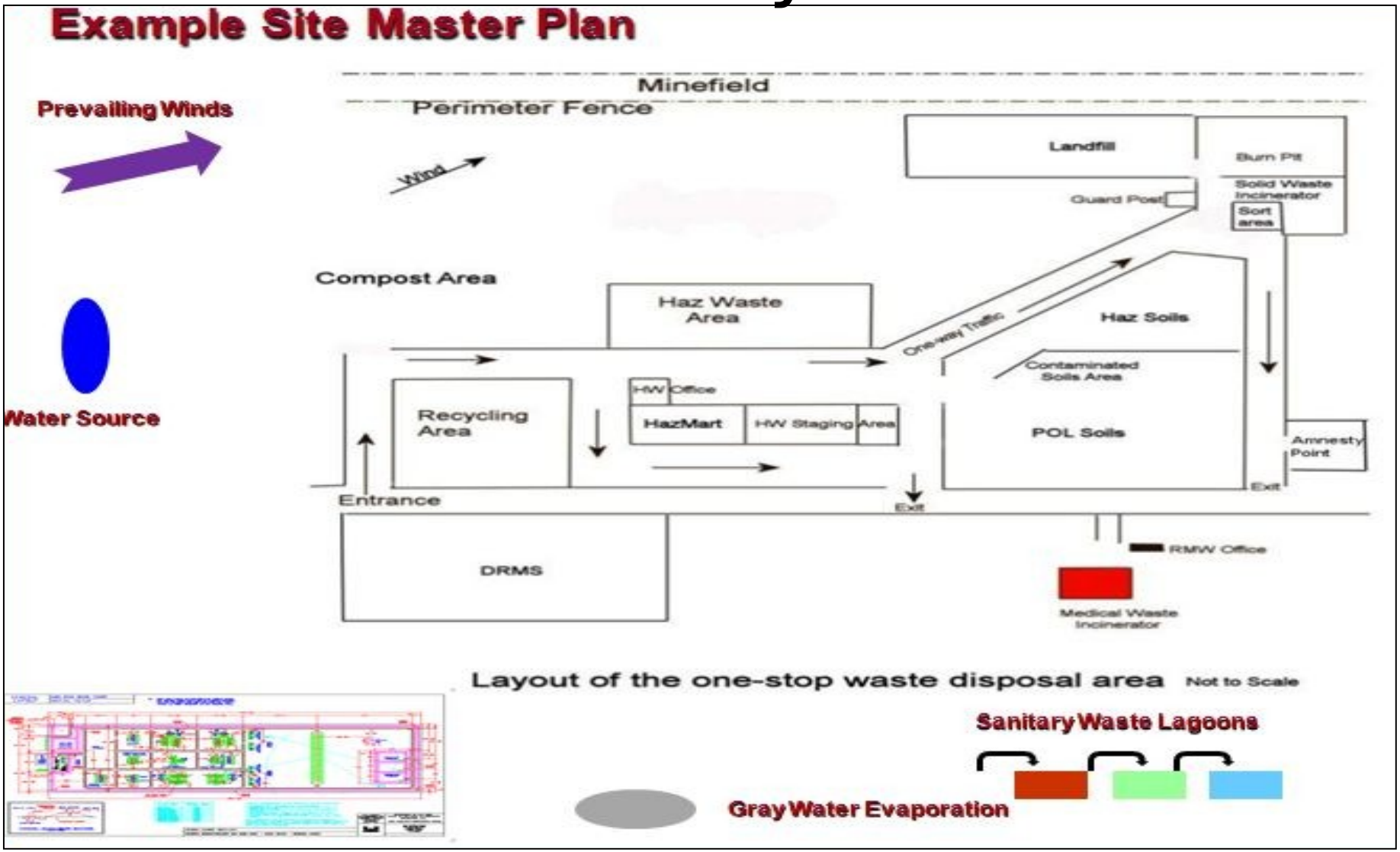
Learning Objective #5

Describe the layout of an integrated waste management plan.

Planning Considerations

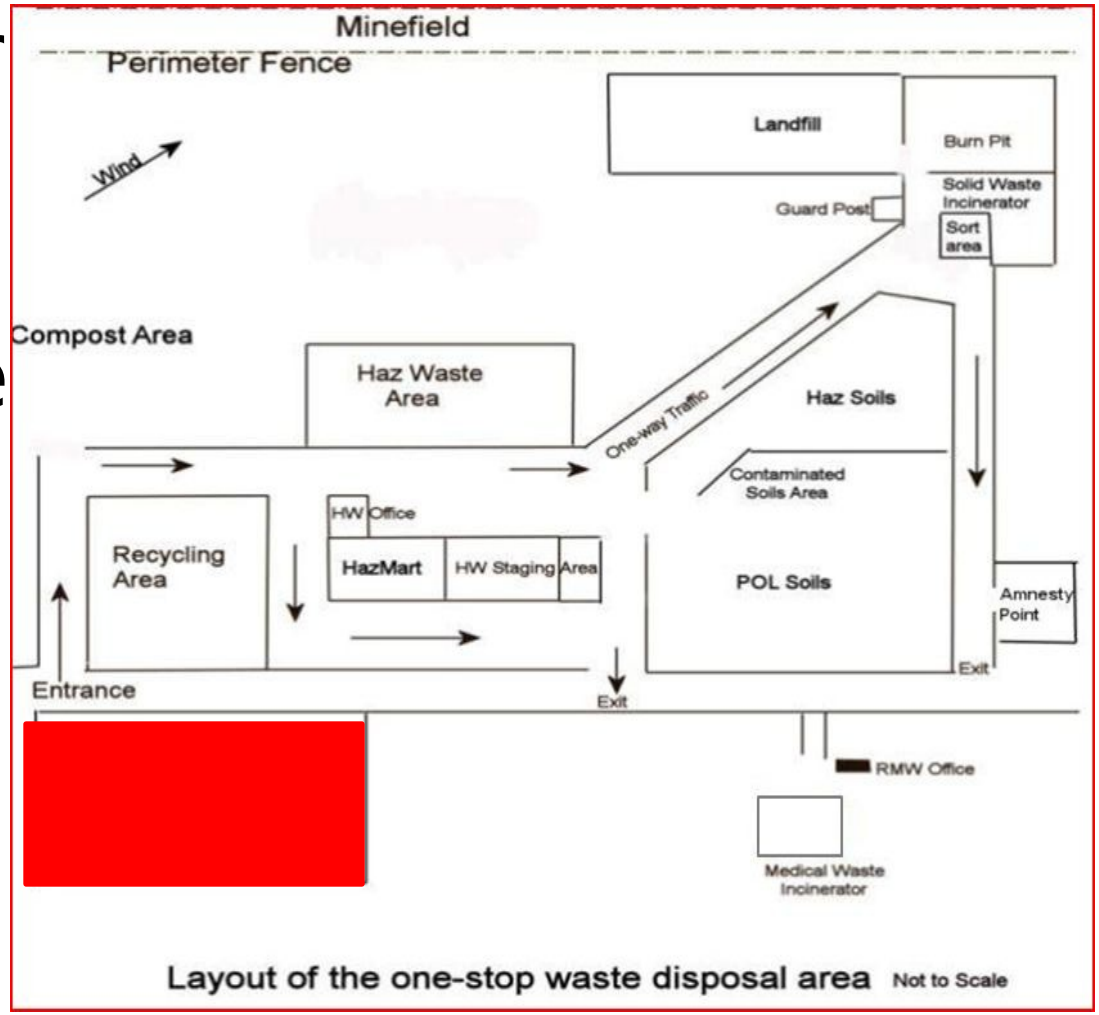
- Proximity to water source, living area, and DFAC
- Surrounding Land use
- Terrain
- Weather
- Neighboring Communities
- Prevailing Wind
- Geology/Soils

Integrated Waste Management Plan Layout



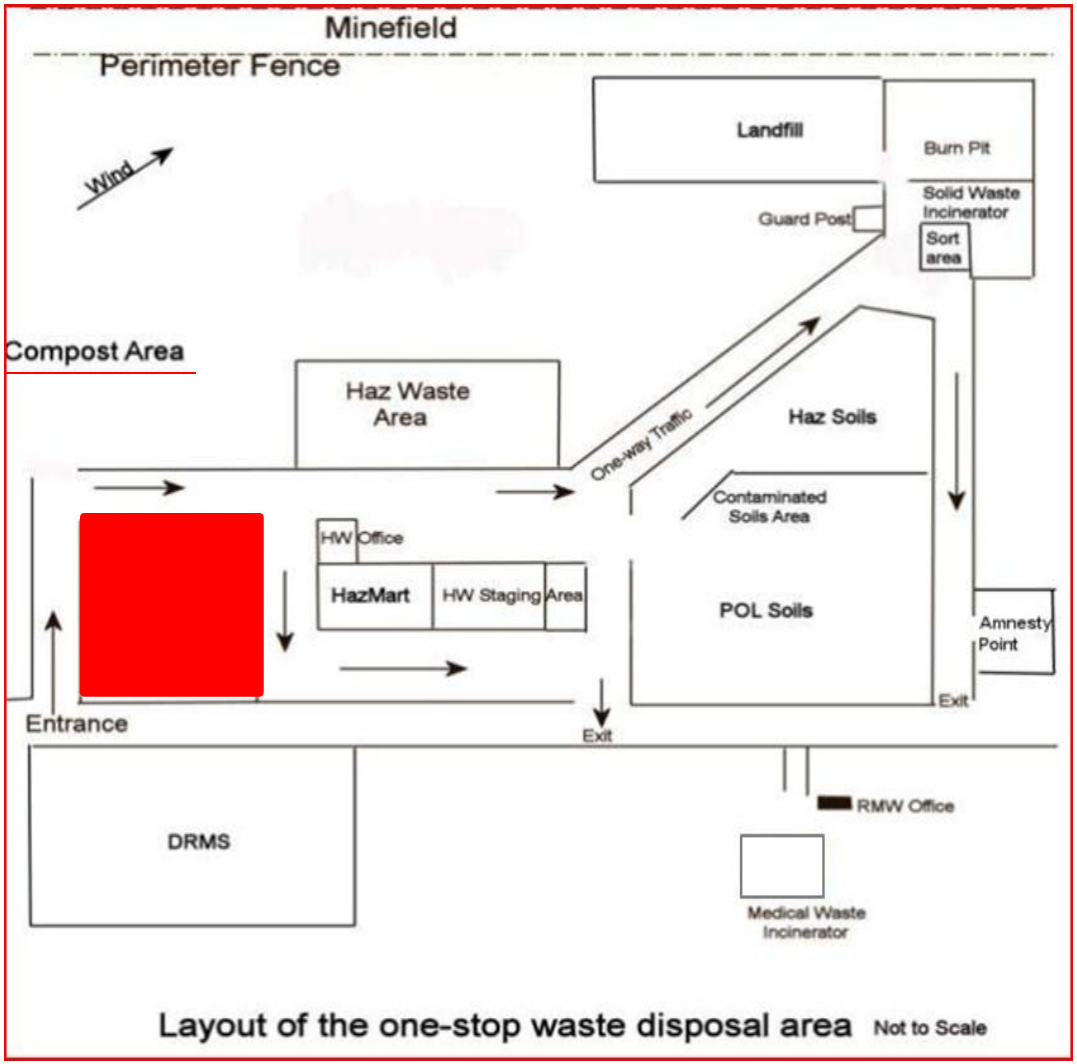
Defense Reutilization and Marketing Service (DRMS)

- DoD's choice for disposal of excess property
- Worldwide reuse recycling, and disposal solutions

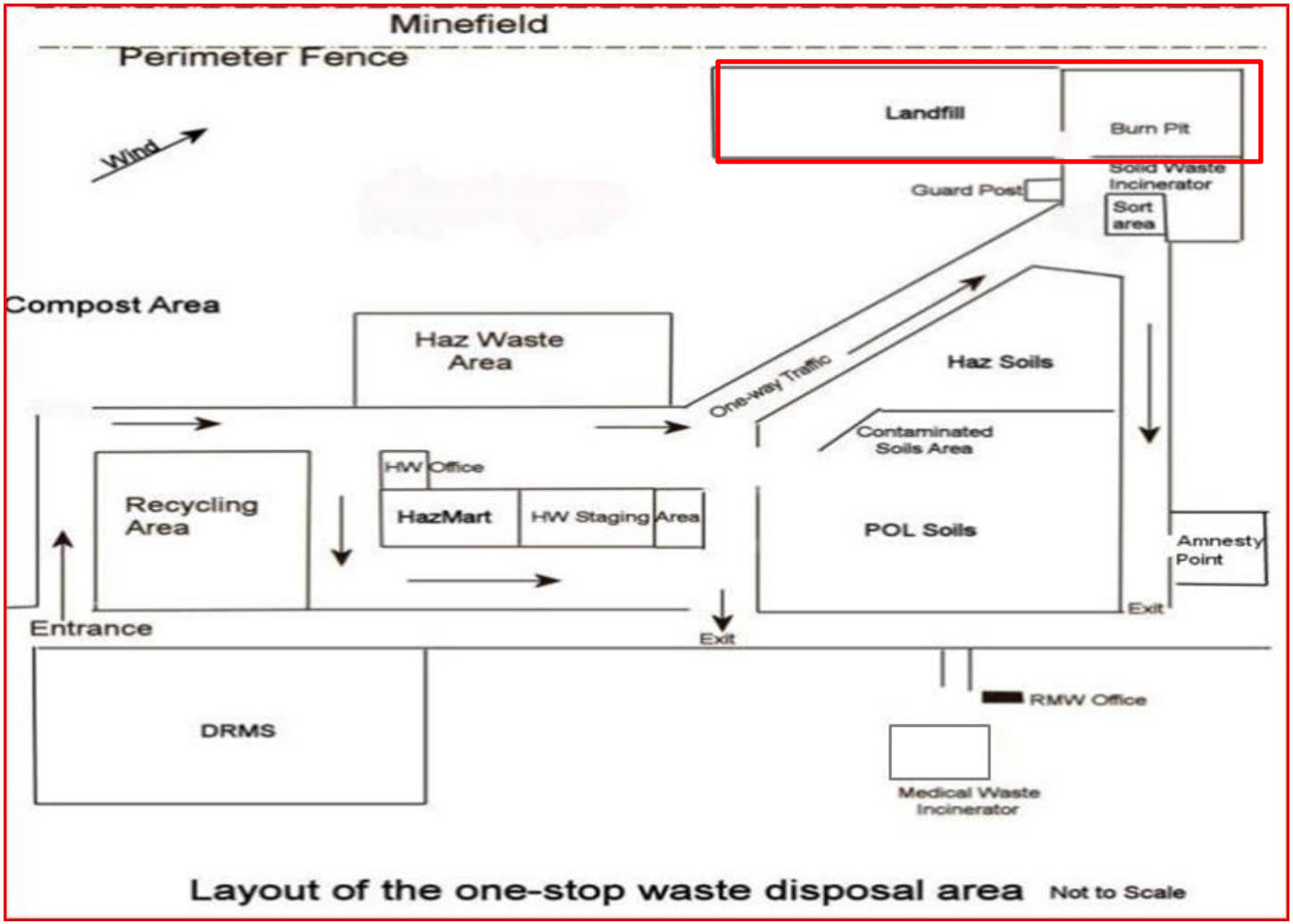


Recycling/ Compost Area

- Secondary staging of recyclable materials
- Segregation is critical
- Compost area will accept putrescible waste and food waste

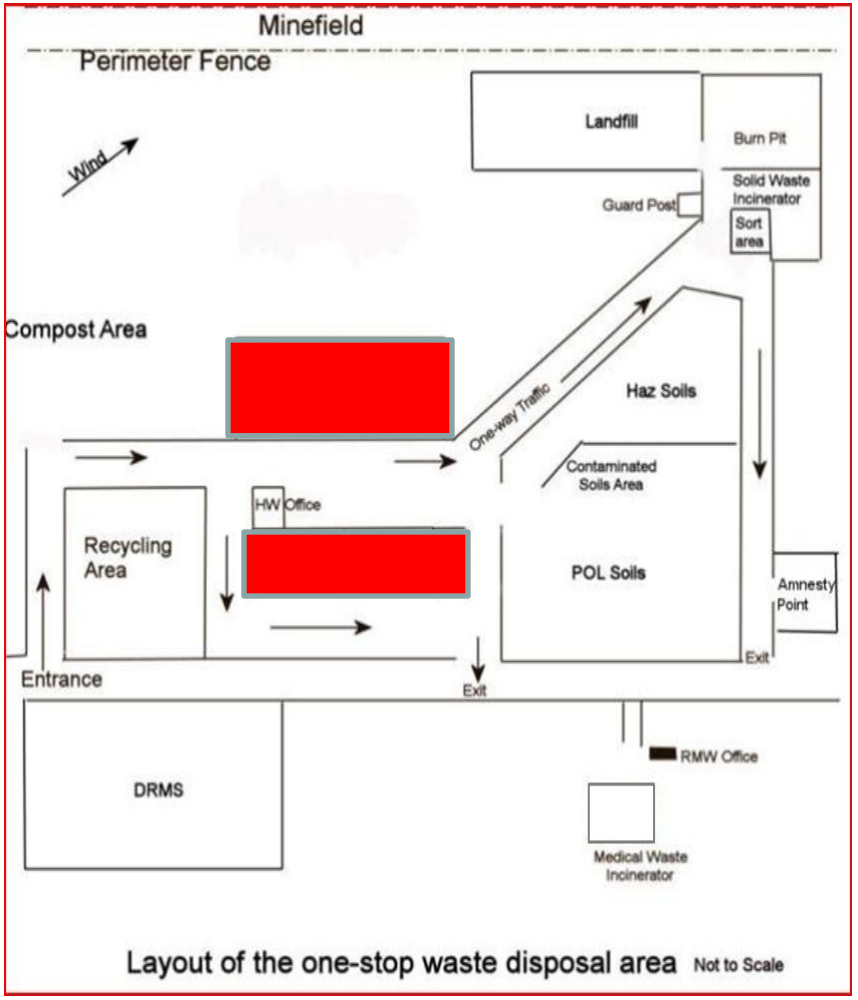


Solid Waste Disposal



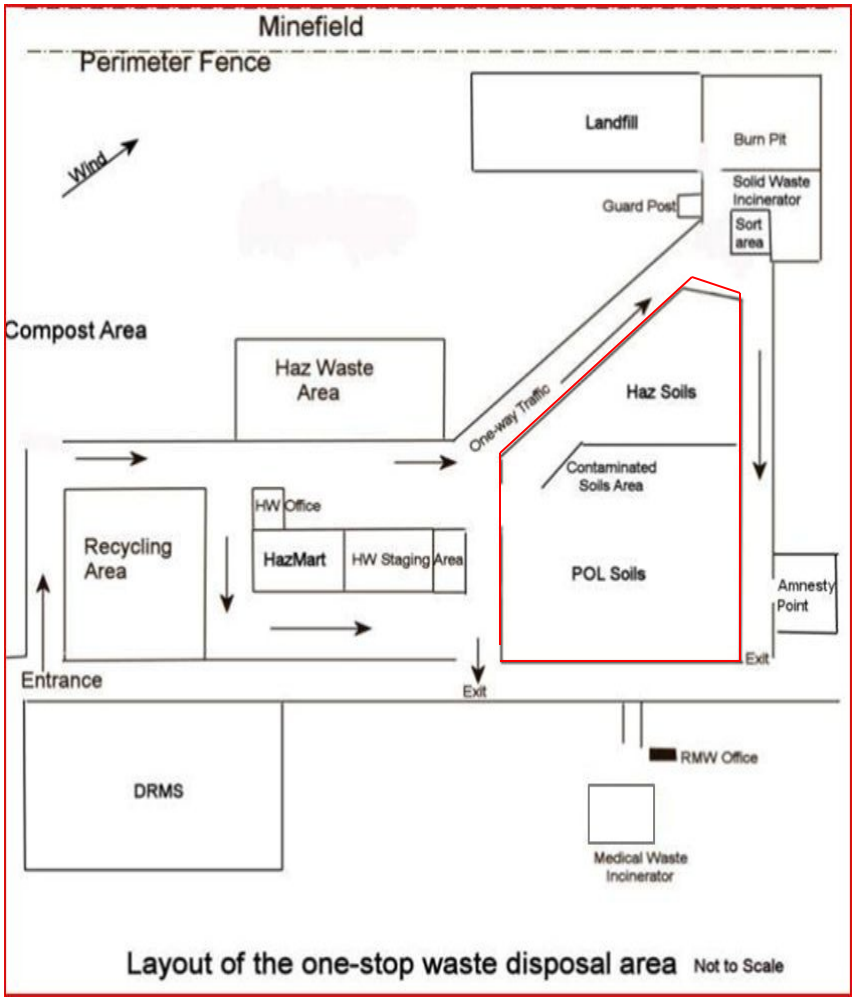
Hazmart/Hazardous Waste Storage Area

- Sorting areas for re-usable hazardous materials and hazardous waste
- Hazardous waste storage yard



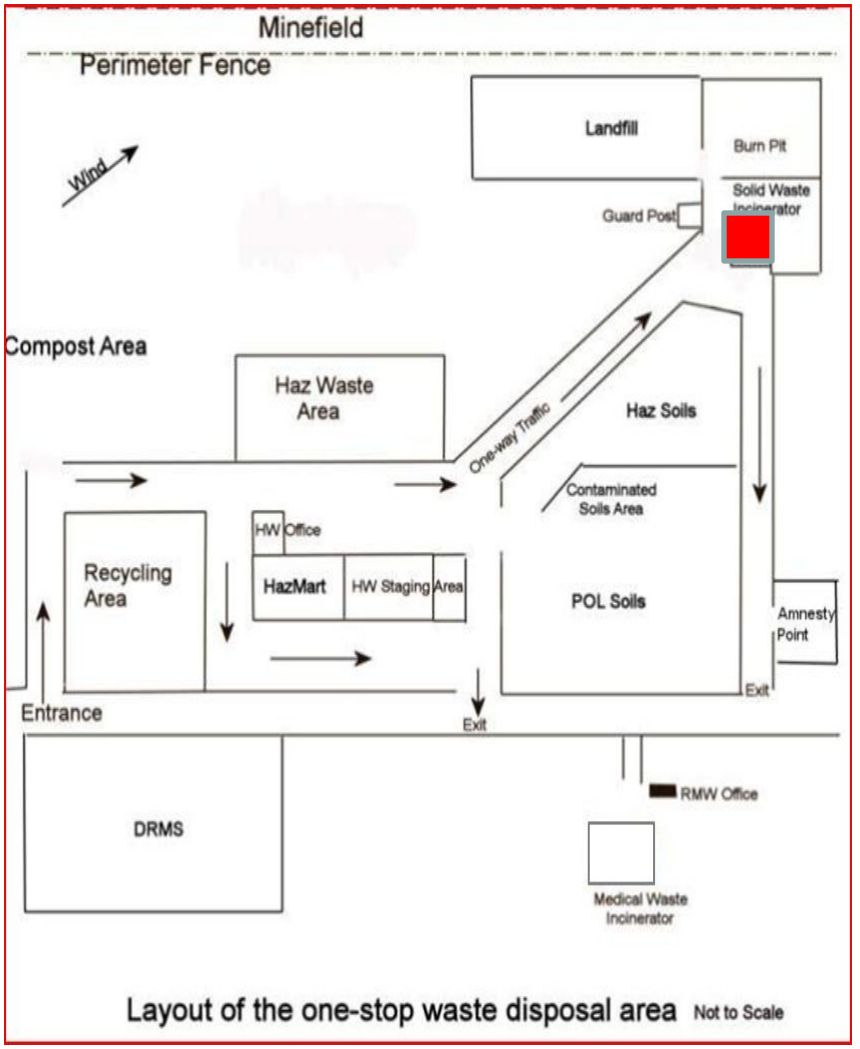
Petroleum, Oil, Lubricant (POL) Contaminated Soils

- Area capable of accepting contaminated soils
- Aerobic decomposition
- Land farming



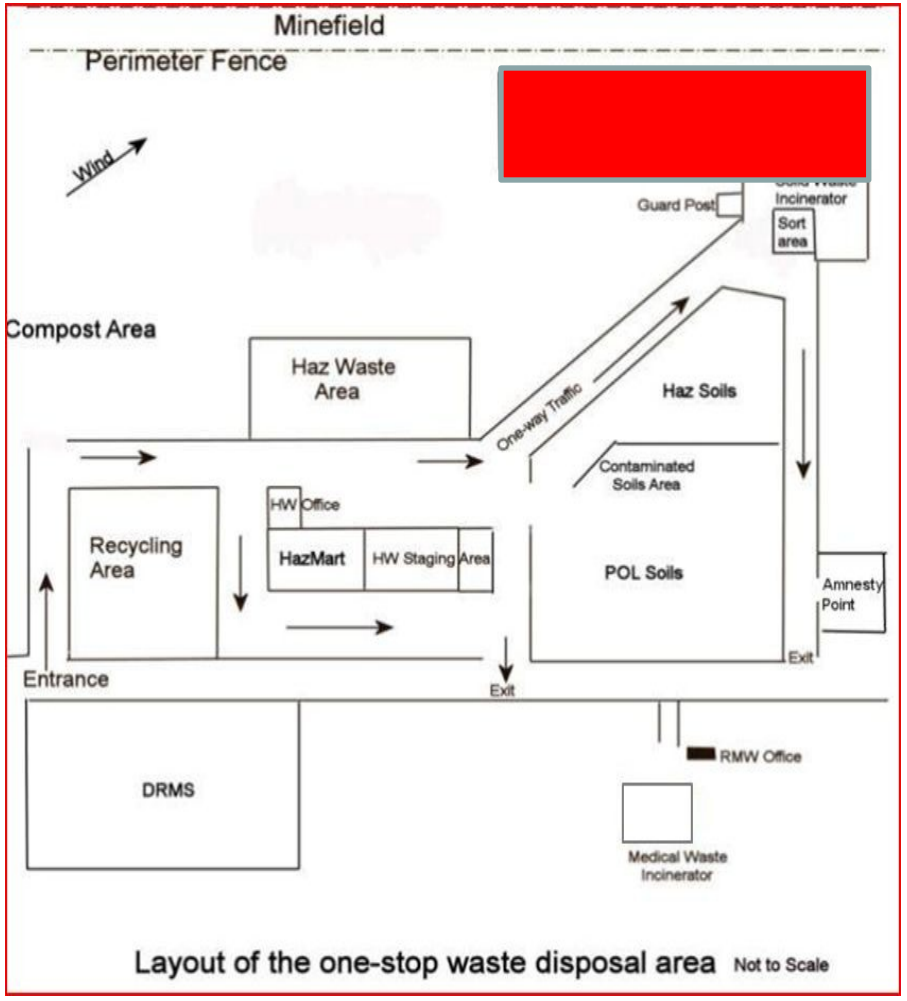
Final Sorting Area

- Waste is dumped and sorted a final time.
- Taken to incinerator, burn pit, and/or landfill



Solid Waste Disposal

- Burn Pit
- Incinerator
- Landfill



Check on Learning

What are some planning considerations for the layout of an integrated waste management area?

Summary

- Taking into account environmental impacts before and during mission activities we can reduce or eliminate some of those impacts.

- Those reductions can assist in expediting the time it will take to properly close the base camp and return our troops back to their families.